

Fall 9-7-2006

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## Recommended Citation

Prakriti P, Liu J, Lockhart T & Courtney Haynes. Analysis of Gait Characteristics in Mentally Handicapped Individuals. Paper presented at American Society of Biomechanics 30th Annual Meeting; September 7-9, 2006; Virginia Tech, Blacksburg, VA, USA.

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# ANALYSIS OF GAIT CHARACTERISTICS IN MENTALLY HANDICAPPED INDIVIDUALS

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## INTRODUCTION

Physical and motor dysfunctions in mentally handicapped individuals predispose them to a higher risk of slip and fall accidents. It is estimated that over 60 million people are currently suffering with some level of developmentally related cognitive impairment (American Disability Act ADA, 2000). Mental retardation occurs in 2.5-3% of the general population. About 6-7.5 million mentally retarded individuals live in the United States alone (ADA, 2000). Slip induced fall accidents are a primary source of injury in people with mental retardation (MR). Often, the incidence of falls among this population is compounded by other disabilities such as autism, seizure, and impulse control disorders. These individuals already have a certain level of physical disability which makes it necessary to predict their tendency of falling in-order to prevent further physical disability. Due to improvements in the health care and assisted living services available to them, many more individuals with MR are reaching old age. In fact, there are between 200,000 and 500,000 older adults with MR in the United States (World Health Organization, 2000). As this population continues to grow, it is important to identify individuals who are at an elevated risk of slip induced fall accidents.

While gait characteristics have been documented for a variety of disabled and non-disabled populations, there is little reliable data on the gait patterns of individuals with MR. Understanding the gait

patterns of this population would be helpful in identifying the factors that might relate to their incidence of falls and eventually developing intervention strategies to minimize the injuries due to falls. Therefore, the purpose of this study was to examine the gait characteristics in mentally impaired individuals with various degrees of MR (Mild, Moderate, Severe and Profound).

## METHODS

Twenty mentally retarded individuals were recruited from Southwest Virginia Training Center (SWVTC). Informed consent was approved by IRB in both the SWVTC and Virginia Tech. The participant's information is summarized in Table 1. The experimental protocol was very similar to previous literature [1]. Participants were instructed to walk along a linear walkway (1.5m x 15.5m), and were protected by an overhead harness system. Two force-plates and a six-camera ProReflex system were used to collect kinetic and motion data. SWVTC staff helped the experimenters to subjectively judge if the way the participants walked was consistent with their daily walking style.

Table 1: Participants Information

n = 20		
MR Status (IQ)	No. of Subjects	Age Range
Mild (55-69)	1	34
Moderate (40-54)	5	23-37
Severe (25-39)	11	24-64
Profound (below 25)	3	31-42

Totally 8 normal walking trials were collected per participant. Step length (SL), heel contact velocity (HCV), and whole-body COM speed (SP) were determined in custom-made MATLAB program [2]. All the parameters were compared with the control group of 20 younger healthy participants, whose data were collected previously using similar experimental protocol. Paired-t tests were performed to assess group effect (mentally retarded group (MR) and healthy younger group (N)) on SL, HCV, and SP. Significant level  $p < 0.05$  was adopted for all the tests.

## RESULTS

Figure 1 demonstrates the summary of the differences in gait parameters between the MR and the control group. The paired-t tests indicated that the MR group walked slower than the control group ( $p < 0.0001$ ). Also, younger adults horizontal heel contact velocity was faster and their step length significantly longer ( $p < 0.0001$ ) than the MR group.

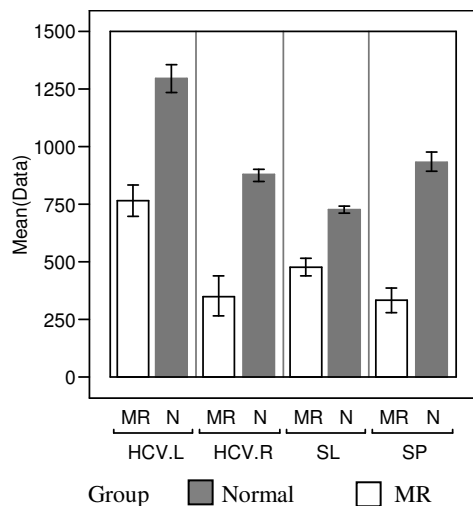


Figure1: Mean and standard deviation of HCV (mm/s) right (R) and Left (L), SL (mm), and SP (mm/s) in mentally retarded group and control group

## DISCUSSION AND CONCLUSION

The objective of the study was to evaluate gait characteristics of the mentally impaired individuals and relate them to their propensity of falls. Previous literature [1] suggested that SP, HCV and SL were major predictors of likelihood of slips and falls. The results obtained in this study indicate that the gait of mentally impaired individuals is similar to that of older individuals with high frequency of falls [3]. The higher heel contact velocity is a predictor variable of the required coefficient of friction (RCOF) which affects the slip initiation. Though there were differences between the HCV of young and the MR group, the results suggest that the evaluated parameters might not affect the slip initiation process of these individuals. However, slower whole body COM velocity has been recognized as a contributing factor for falls [3]. This indicates that mentally impaired individuals might be at a risk of fall when their gait is perturbed, as their whole body COM transfer will be slower which might affect their recovery process. These results warrant further investigation of gait parameters which affect the recovery from slips in mentally impaired individuals.

In conclusion, the present study indicated that the gait characteristics of the MR group were significantly different from the younger individuals which might affect their reactive recovery from a fall.

## REFERENCES

1. Liu, J. et al. (2004). *Proceedings of HFES 48th Annual Meeting*.
2. Lockhart, T. E. et al.(2002). *ASTM STP 1424, Metrology of Pedestrian Locomotion and Slip Resistance*.
3. Kim, S. et al. (2005). *Safety science 43: 425-436*